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Source Test Report for 2023 Compliance Testing
Omo Road Station Gas Fired Turbine-EUTUR01
Bluewater Gas Storage, LLC
Ray Township, Michigan

Prepared For:

Bluewater Gas Storage
333 S. Wales Center
Columbus, MI 48063

Prepared By:

Montrose Air Quality Services, LLC
1371 Brummel Avenue
Elk Grove Village, IL 60007

For Submission To:

Michigan Department of Environment, Great Lakes and Energy
525 West Allegan Street
Lansing, Michigan 48933

Document Number: MW023AS-021939-RT-1670
Test Date: January 10, 2023
Submittal Date: February 10, 2023

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ACCREDITED
TO ASTM D7036 ONLY
CERT #3925.01

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Review and Certification

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature:	Brandon Check	**Date:**	02 / 07 / 2023
Name:	Brandon Check, QI	**Title:**	Client Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature:	Henry M. Taylor	**Date:**	02 / 06 / 2023
Name:	Henry M. Taylor, QSTO	**Title:**	Senior Reporting Specialist

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1.0 Introduction

1.1 Summary of Test Program

Bluewater Gas Storage, LLC (Bluewater) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test on the Omo Road Station Natural Gas Fired Turbine (EUTUR01) at their facility located in Ray Township, Michigan.

The test was conducted to satisfy the requirements of the Michigan Department of Environment, Great Lakes and Energy (EGLE) PTI, the United States Environmental Protection Agency (EPA), 40 CFR 63.6640 (c), Subpart ZZZZ and KKKK as applicable.

The specific objectives were to:

- Determine the NO_x and CO emissions from EUTUR01
- Conduct the test program with a focus on safety

Montrose performed the test to measure the emission parameters listed in Table 1-1.

Table 1-1
Summary of Test Program

Test Date	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
1/10/23	EUTUR01/Omo Road Station	O_2	EPA 3A	3	30
	Natural Gas Fired Turbine	NO_x	EPA 7E & 19	3	30
		CO	EPA 10 & 19	3	30
		SO_2*	--	--	--

To simplify this report, a list of Units and Abbreviations is included in Appendix C.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling location, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Table 1-2. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The test was conducted according to the Test Protocol No. MW023AS-021939-PP-540 dated November 4, 2022.

*The permit has an exception allowing the site to use tariff sheets to calculate SO_2 instead of Montrose performing EPA Method 6C. Results for SO_2 were provided by Bluewater.

Table 1-2
Summary of Average Compliance Results –Turbine EUTUR01

January 10, 2023

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO_x)		
ppmvd	7.37	--
ppmvd @ 15% O_2	7.81	25
lb/MMBtu	0.0285	--
lb/hr	1.86	5.18
Carbon Monoxide (CO)		
ppmvd	1.55	--
ppmvd @ 15% O_2	1.65	--
lb/MMBtu	0.0036	--
lb/hr	0.24	5.25
Sulfur Dioxide (SO_2)		
lb/MMBtu	See Appendix B.2	0.060

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location:	Bluewater Gas Storage 333 S Wales Center Columbus, MI 48063
Project Contact:	James Jensen
Company:	Bluewater Gas Storage, LLC
Telephone:	414-221-2530
Email:	James.Jensen@wecenergygroup.com

Agency Information

Regulatory Agency:	Michigan Department of Environment, Great Lakes and Energy
Agency Contact:	Jeremy Howe
Telephone:	231-878-6687
Email:	Howej@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC
Contact:	Brandon Check
Title:	Client Project Manager
Telephone:	630-860-4740
Email:	bcheck@montrose-env.com

Test personnel and observers are summarized in Table 1-3.

Table 1-3
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
Matthew Libman	Montrose	Regional Vice President/Field Team Leader/Trailer Operator
Brian Romani	Montrose	Field Project Manager/QI/Trailer Operator
Jack Hutchison	Montrose	Report Preparation
James Jensen	Bluewater	Client Liaison/Test Coordinator

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

Bluewater primarily provides seasonal storage needs throughout the Midwestern and Northeastern portions of the U.S. and the Southeastern portion of Canada. Bluewater's customers consist primarily of pipelines, utilities and marketers seeking seasonal storage services. Bluewater's 30-mile, 20-inch diameter pipeline header system connects with three interstate and three intrastate natural gas utility pipelines that provide access to the major market hubs of Chicago, Illinois and Dawn, Ontario, which supply natural gas to eastern Ontario and the northeastern United States. These interconnects also provide access to natural gas utilities that serve local markets in Michigan and Ontario.

The compliance test was conducted on the Gas Fired Turbine (EUTUR01) at the Omo Road Station facility located in Ray Township, Michigan.

2.2 Flue Gas Sampling Location

Table 2-1
Sampling Location

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
EUTUR01	54	--	--	Gaseous: 3

Sample measurements where conducted at three points on the line passing through the centroidal area at 16.7, 50.0, and 83.3% of the measurement line. Each point was sampled for 10 minutes for each 30-minute test run.

2.3 Operating Conditions and Process Data

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B. Data collected includes the following parameters:

- Fuel factor, F_d
- Fuel gas flow rate, MSCFH
- Heating value, BTU/scf
- Heat input (MMBTU/hr)

Process data information is summarized in Table 2-2.

Table 2-2
Process Data

Run	Temperature (°F)	Humidity (%)	Pressure (in)	Engine Temperature (°F)	Fuel Flow (MSCFH)	Fuel Consumed (MSCF)
1	33	84	30.05	1371	61.5	30.8
2	35	77	30.03	1371	61.3	30.7
3	36	74	30.02	1373	62.4	31.2
Average	34.7	78.3	30.03	1371.7	61.7	30.9

3.0 Sampling and Analytical Procedures

3.1 Test Methods

The test methods for this test program have been presented in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Methods 3A, 7E, and 10, Determination of Oxygen, Nitrogen Oxides, and Carbon Monoxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

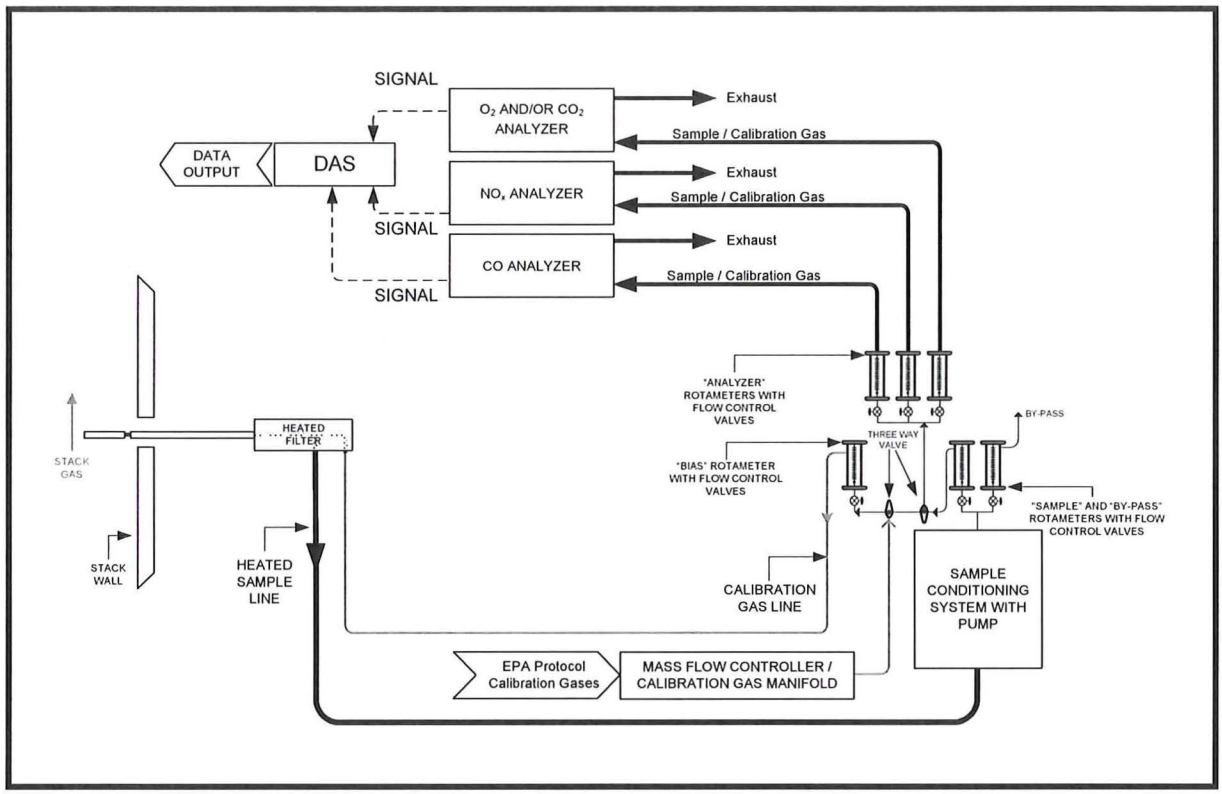
Concentrations of O_2, NO_X, and CO are measured simultaneously using EPA Methods 3A, 7E, and 10, which are instrumental test methods. Conditioned gas is sent to a series of analyzers to measure the gaseous emission concentrations. The performance requirements of the method must be met to validate the data.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - A dry extractive sampling system is used to report emissions on a dry basis
  - A paramagnetic analyzer is used to measure O_2
  - A chemiluminescent analyzer is used to measure NO_X
  - A gas filter correlation nondispersive infrared analyzer is used to measure CO
- Method Exceptions:
  - None
- Target and/or Minimum Required Sample Duration: 30 minutes
- Target Analytes: O_2, NO_X, and CO

The typical sampling system is detailed in Figure 3-1.

Figure 3-1
EPA Method 3A, 7E, and 10 Sampling Train



3.1.2 EPA Method 19, Measurement of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates

EPA Method 19 is a manual method used to determine (a) PM, SO_2, and NO_x emission rates; (b) sulfur removal efficiencies of fuel pretreatment and SO_2 control devices; and (c) overall reduction of potential SO_2 emissions. This method provides data reduction procedures, but does not include any sample collection or analysis procedures.

EPA Method 19 is used to calculate the stack gas volumetric flow rate from the measurement of the heat input rate, stack concentration of O_2 or CO_2, and an F factor determined from fuel analysis. Volumetric flow rates are used to calculate mass emission rates in units of lb/hr. The metered fuel flow rate is recorded during each test period. Typically, fuel flow rates are reported in scf/hr. A fuel sample is collected and analyzed for higher heating value (HHV) and composition (C,H,O,N,S) to calculate the F factor. F factors are determined daily, if not more frequently, from each unique fuel supply.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - F factor is the oxygen-based F factor, dry basis (F_d)
  - F factor is calculated from analysis of fuel samples collected on the test day
  - Higher Heating Value data is obtained from analysis of fuel samples
- Method Exceptions:
  - None

3.2 Process Test Methods

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

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4.0 Test Discussion and Results

4.1 Field Test Deviations and Exceptions

No field deviations or exceptions from the test plan or test methods occurred during this test program.

4.2 Presentation of Results

The average results are compared to the permit limits in Table 1-2. The results of individual compliance test runs performed are presented in Table 4-1. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

Table 4-1
NO_x and CO Emissions Results -
Turbine EUTUR01

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	1/10/2023	1/10/2023	1/10/2023	--
Time	10:58-11:28	11:40-12:10	12:21-12:51	--
Process Data				
fuel factor, F_d	8,613	8,613	8,613	8,613
fuel flow, MSCFH	61.50	61.30	62.40	61.73
heating value, BTU/scf	1061.4	1057.4	1057.3	1058.7
heating input, MMBTU/hr	65.28	64.82	65.98	65.36
Sampling & Flue Gas Parameters				
sample duration, minutes	30	30	30	--
O_2, % volume dry	15.28	15.36	15.37	15.34
Nitrogen Oxides (NO_x as NO_2)				
ppmvd	7.32	7.29	7.48	7.37
ppmvd @ 15% O_2	7.69	7.77	7.98	7.81
lb/MMBtu	0.0280	0.0283	0.0291	0.0285
lb/hr	1.83	1.83	1.92	1.86
Carbon Monoxide (CO)				
ppmvd	2.00	1.32	1.34	1.55
ppmvd @ 15% O_2	2.10	1.41	1.43	1.65
lb/MMBtu	0.0047	0.0031	0.0032	0.0036
lb/hr	0.30	0.20	0.21	0.24

5.0 Internal QA/QC Activities

5.1 QA/QC Audits

EPA Method 3A, 7E, and 10 calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks.

5.2 QA/QC Discussion

All QA/QC criteria were met during this test program.

5.3 Quality Statement

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one QI as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).

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Appendix A
Field Data and Calculations

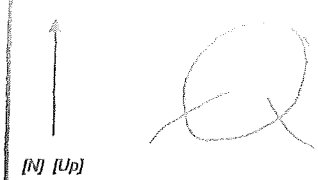
Appendix A.1
Sampling Location

EPA Method 1

Sample and Velocity Traverses Datasheet

LOCATION

Client	Blue water
Project No.	21939
Plant	oro lord
Date	1/9/23
Technician	BR
Duct Diameter (in)	54"
Port Diameter (in)	—
Port Length (in)	—
Port Type	—
Distance A (ft)	—
Distance B (ft)	—
Distance A (Duct Diameters)	—
Distance B (Duct Diameters)	—



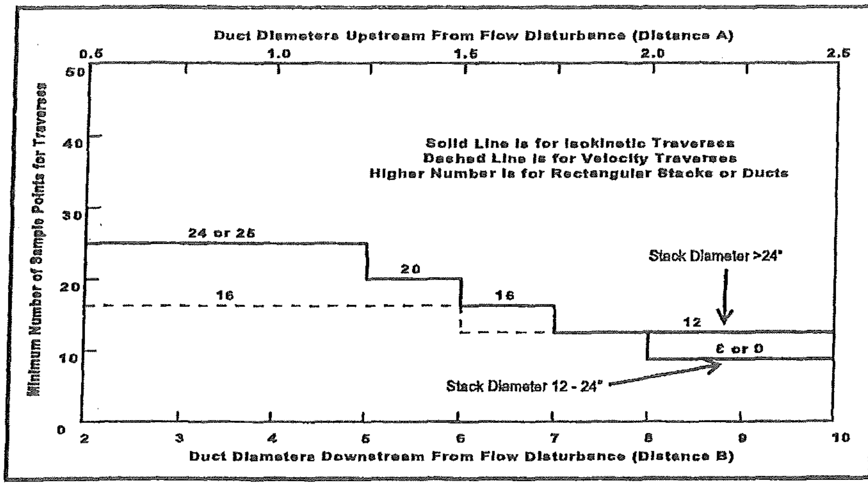
[N] [Up]

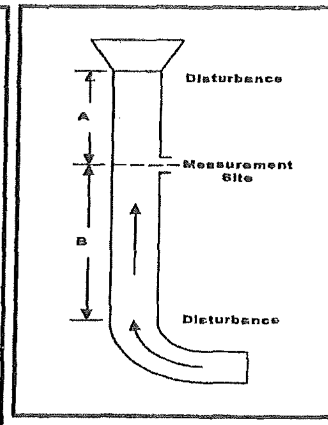
First point all the way [in] [out]

Gas flow [in] [out] of page

Cross Section of Duct

For rectangular ducts $ED = \frac{2LW}{(L+W)}$





Stacks D > 24" min. ≥1.00" away from wall

Stacks D ≤ 24" min. ≥0.50" away from wall

Location Schematic and Notes	Traverse Point	Distance (in)	% D
	1	44.98	83.3
	2	27	50
	3	9.02	16.7
	4		
	5		
	6		
	7		
	8		
	9		
	10		
	11		
	12		
	13		
	14		
	15		
Indicate sample ports, height from grade, types of disturbances, access, unistrut configuration, etc. *Distance to point must include length of port*	16		

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Appendix A.2
Instrumental Test Method Data

Date
1/10/2023

Time	O_2 (%)	NO_X (ppm)	CO (ppm)
Average	15.37	7.44	2.01
10:58:02	15.33	7.63	4.1
10:59:02	15.34	7.71	3.6
11:00:02	15.33	7.69	3.0
11:01:02	15.33	7.64	2.6
11:02:02	15.33	7.68	2.4
11:03:02	15.32	7.62	2.3
11:04:02	15.32	7.64	2.1
11:05:02	15.32	7.73	2.2
11:06:02	15.31	7.65	2.1
11:07:02	15.32	7.65	2.0
11:08:02	15.32	7.71	2.2
11:09:02	15.32	7.64	1.9
11:10:02	15.32	7.69	1.7
11:11:02	15.32	7.46	1.6
11:12:02	15.32	7.43	1.5
11:13:02	15.32	7.34	1.7
11:14:02	15.33	7.45	1.6
11:15:02	15.33	7.42	1.5
11:16:02	15.33	7.37	1.6
11:17:02	15.33	7.69	1.5
11:18:02	15.34	7.44	1.6
11:19:02	15.35	7.35	1.6
11:20:02	15.39	7.15	1.6
11:21:02	15.5	7.1	1.8
11:22:02	15.48	7.09	1.8
11:23:02	15.5	7.18	1.9
11:24:02	15.5	7.13	1.8
11:25:02	15.51	7.12	1.9
11:26:02	15.5	7.19	1.8
11:27:02	15.5	7.09	1.9
11:28:02	15.5	7.11	1.5

Date
1/10/2023

Time	O_2 (%)	NO_X (ppm)	CO (ppm)
Average	15.35	7.39	1.35
11:40:17	15.31	7.72	0.9
11:41:17	15.31	7.64	1.2
11:42:17	15.31	7.45	1.3
11:43:17	15.28	7.7	1.3
11:44:17	15.27	7.71	1.3
11:45:17	15.29	7.61	1.3
11:46:17	15.3	7.68	1.3
11:47:17	15.31	7.61	1.3
11:48:17	15.31	7.62	1.2
11:49:17	15.31	7.7	1.3
11:50:17	15.3	7.64	1.3
11:51:17	15.3	7.57	1.3
11:52:17	15.31	7.45	1.3
11:53:17	15.3	7.36	1.3
11:54:17	15.3	7.34	1.3
11:55:17	15.31	7.39	1.3
11:56:17	15.31	7.36	1.3
11:57:17	15.31	7.35	1.3
11:58:17	15.31	7.38	1.2
11:59:17	15.31	7.44	1.4
12:00:17	15.31	7.35	1.3
12:01:17	15.31	7.38	1.2
12:02:17	15.42	7.42	1.4
12:03:17	15.45	7.08	1.5
12:04:17	15.46	6.8	1.6
12:05:17	15.46	6.94	1.6
12:06:17	15.47	7.09	1.5
12:07:17	15.47	7.06	1.6
12:08:17	15.47	7.18	1.6
12:09:17	15.46	7.06	1.6
12:10:17	15.46	7.09	1.6

Date
1/10/2023

Time	O_2 (%)	NO_X (ppm)	CO (ppm)
Average	15.34	7.49	1.32
12:21:57	15.44	7	0.7
12:22:57	15.33	7.9	1.3
12:23:57	15.27	9	1.5
12:24:57	15.24	7.88	1.4
12:25:57	15.25	7.64	1.3
12:26:57	15.28	7.68	1.1
12:27:57	15.29	7.67	1.1
12:28:57	15.28	7.64	1.1
12:29:57	15.28	7.60	1.1
12:30:57	15.28	7.61	1.3
12:31:57	15.28	7.66	1.3
12:32:57	15.28	7.61	1.3
12:33:57	15.29	7.56	1.3
12:34:57	15.29	7.58	1.3
12:35:57	15.29	7.39	1.3
12:36:57	15.29	7.36	1.3
12:37:57	15.29	7.38	1.3
12:38:57	15.29	7.34	1.3
12:39:57	15.29	7.39	1.3
12:40:57	15.29	7.63	1.3
12:41:57	15.33	7.55	1.3
12:42:57	15.43	7.36	1.3
12:43:57	15.43	7.17	1.3
12:44:57	15.43	7.1	1.5
12:45:57	15.43	7.06	1.6
12:46:57	15.43	7.23	1.6
12:47:57	15.43	7.33	1.6
12:48:57	15.42	7.3	1.5
12:49:57	15.41	7.21	1.6
12:50:57	15.42	7.17	1.6
12:51:57	15.41	7.3	1.6

Appendix A.3
Calculations/Results

OXYGEN

Analyzer Values	Actual	Cal Error	Bias	Run 1	Run 2	Run 3
Date		1/10/23	1/10/23	1/10/23	1/10/23	1/10/23
Start Time		9:31	9:52	10:58	11:40	12:21
Stop Time		9:52	9:58	11:28	12:10	12:51
Concentration, C (%)				15.37	15.35	15.34
Zero Cal Gas, C_0 (%)	0.00	0.0	0.0	0.0	0.0	0.0
Mid Cal Gas (%)	9.938	10.1				
High Cal Gas (%)	21.10	21.1				
Span Value (%)	21.10					
Bias/Drift Check Gas, C_s (%)	9.938		10.1	9.9	9.9	9.9
RESULTS						
Zero Error (%)	2 % of Span	0.0				
Mid Error (%)		0.6				
High Error (%)		0.0				
Upscale Error (%)						
Zero Bias (%)	5 % of Span		0.0	0.0	-0.1	0.0
Upscale Bias (%)			-0.1	-0.7	-0.7	-0.8
Zero Drift (%)	3 % of Span			0.0	0.0	0.0
Upscale Drift (%)				-0.6	0.0	-0.1
Concentration Corrected for Drift, C_d (%)				**15.28**	**15.36**	**15.37**

NITROGEN OXIDES

Correction to Oxygen (%)	15.0
Correction to Fd Factor (lb/MMBtu)	8,613

Analyzer Values	Actual	Cal Error	Bias	Run 1	Run 2	Run 3
Date		1/10/23	1/10/23	1/10/23	1/10/23	1/10/23
Start Time		9:31	9:52	10:58	11:40	12:21
Stop Time		9:52	9:58	11:28	12:10	12:51
Concentration, C (ppm)				7.44	7.39	7.49
Zero Cal Gas, C_0 (ppm)	0.00	0.14	0.2	0.1	0.1	0.1
Mid Cal Gas (ppm)	25.51	25.7				
High Cal Gas (ppm)	45.36	45.4				
Span Value (ppm)	45.36					
Bias/Drift Check Gas, C_s (ppm)	25.51		25.5	25.6	25.5	25.1

RESULTS						
Zero Error (%)	2 % of Span	0.3				
Mid Error (%)		0.3				
High Error (%)		0.0				
Upscale Error (%)						
Zero Bias (%)	5 % of Span		0.1	0.0	-0.1	-0.1
Upscale Bias (%)			-0.3	-0.1	-0.3	-1.2
Zero Drift (%)	3 % of Span			-0.1	-0.1	0.0
Upscale Drift (%)				0.1	-0.2	-0.9
Concentration Corrected for Drift, C_d (ppm)				**7.32**	**7.29**	**7.48**
Concentration Corrected to Oxygen, C_{O2} (ppm)				**7.69**	**7.77**	**7.98**
Emission Rate, Fd Factor, E_{Fd} (lb/MMBtu)				**0.0280**	**0.0283**	**0.0291**

CARBON MONOXIDE

Correction to Oxygen (%)	15.0
Correction to Fd Factor (lb/MMBtu)	8,613

Analyzer Values	Actual	Cal Error	Bias	Run 1	Run 2	Run 3
Date		1/10/23	1/10/23	1/10/23	1/10/23	1/10/23
Start Time		9:31	9:52	10:58	11:40	12:21
Stop Time		9:52	9:58	11:28	12:10	12:51
Concentration, C (ppm)				2.01	1.35	1.32
Zero Cal Gas, C_0 (ppm)	0.00	0.16	0.0	0.0	0.1	0.0
Mid Cal Gas (ppm)	24.98	25.0				
High Cal Gas (ppm)	45.25	45.2				
Span Value (ppm)	45.25					
Bias/Drift Check Gas, C_s (ppm)	24.98		25.1	24.6	24.7	24.4
RESULTS						
Zero Error (%)	2 % of Span	0.4				
Mid Error (%)		0.1				
High Error (%)		-0.2				
Upscale Error (%)						
Zero Bias (%)	5 % of Span		-0.4	-0.3	-0.2	-0.4
Upscale Bias (%)			0.0	-0.9	-0.8	-1.4
Zero Drift (%)	3 % of Span			0.1	0.0	-0.2
Upscale Drift (%)				-0.9	0.1	-0.6
Concentration Corrected for Drift, C_d (ppm)				**2.00**	**1.32**	**1.34**
Concentration Corrected to Oxygen, C_{O2} (ppm)				**2.10**	**1.41**	**1.43**
Emission Rate, Fd Factor, E_{Fd} (lb/MMBtu)				**0.0047**	**0.0031**	**0.0032**

Test Parameters	Run 1	Run 2	Run 3	Average	
Date	1/10/2023	1/10/2023	1/10/2023		
Start Time	10:58	11:40	12:21		
Stop Time	11:28	12:10	12:51		
Gas Conditions					
Oxygen (% dry)	15.28	15.36	15.37	**15.34**	
Fuel Factor, Fd	8,613	8,613	8,613	**8,613**	
Fuel Flow (MSCFH)	61.50	61.30	62.40	**61.73**	
Heating Value (BTU/scf)	1061.4	1057.4	1057.3	**1058.7**	
Heat Input (MMBTU/hr)	65.28	64.82	65.98	**65.36**	
Nitrogen Oxides Results					
Nitrogen Oxides Concentration (ppmdv)	7.32	7.29	7.48	**7.37**	
Nitrogen Oxides Concentration, C (ppmdv@15% O2)	7.69	7.77	7.98	**7.81**	**<25**
Nitrogen Oxides Emission rate, E (lb/mmBTU)	0.0280	0.0283	0.0291	**0.0285**	
Nitrogen Oxides Emission rate (lb/hr)	1.83	1.83	1.92	**1.86**	**<5.18**
Carbon Monoxide Results					
Carbon Monoxide Concentration (ppmdv)	2.00	1.32	1.34	**1.55**	
Carbon Monoxide Concentration, C (ppmdv@15% O2)	2.10	1.41	1.43	**1.65**	
Carbon Monoxide Emission rate, E (lb/mmBTU)	0.0047	0.0031	0.0032	**0.0036**	
Carbon Monoxide Emission Rate (lb/hr)	0.30	0.20	0.21	**0.24**	**<5.25**